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**From:** Lawrence E. Laubscher, Jr.

In re application of

Rickard M. VON WURTEMBERG et al.

Group Art Unit: 2828

Application No. 09/438,955

Examiner: Cornelius Jackson

Filed: November 12, 1999

**Title:** BOTTOM EMITTING VCSEL (VERTICAL CAVITY SURFACE EMITTING LASER) WITH MONITOR EMISSION THROUGH TOP MIRROR

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PATENTS

## IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of

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Group Art Unit: 2828

Application No. 09/438,955

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Filed: November 12, 1999

Title: BOTTOM EMITTING VCSEL (VERTICAL CAVITY SURFACE EMITTING  
LASER) WITH MONITOR EMISSION THROUGH TOP MIRROR**REQUEST FOR RECONSIDERATION OF FINAL REJECTION**Mail Stop AF - GAU 2828  
Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

Sir:

In response to the Office Action dated mailed December 17, 2003, the applicant respectfully requests reconsideration of the final rejection of claims 18-25 as obvious over the patent to Martin et al, either alone or in combination with Imai or Yanagawa.

The Examiner is respectfully requested to review his analysis of Martin, Imai and Yanagawa, because in the applicant's respectful opinion, the Examiner's analysis is incorrect for reasons to be elaborated in more detail below. A combination of Martin and Imai or Yanagawa, when correctly interpreted, cannot fairly be said to result in the invention now claimed in claim 18. It is believed to be accepted that in order to render an invention obvious the prior art must teach, expressly or inherently, all the claimed limitations either alone or in combination. MPEP 2142. Applicants courteously contend that the Examiner has attributed to the prior art teachings that are not actually present.

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Applicants admit that Martin, in the vacuum of investigative research, discloses the use of a photon transparent conductive material, namely Indium Tin Oxide (ITO) as a conductive reflective coating for VCSELs, and that in Martin the ITO is placed on both top and bottom surfaces. As noted, Martin is a research paper that investigates the electrical and optical properties of ITO electrodes in VCSEL structures. Martin expressly states that a VCSEL "is normally pumped electrically through the top and bottom mirrors and the light is collected either from the top or through the substrate", (emphasis added). See line 9 in the *Introduction*. Clearly Martin does not contemplate collecting the light from both the top and bottom surfaces. There is no teaching in Martin that light exits from both the top and the bottom surfaces. Martin expressly teaches the opposite, namely that light only exits from one surface. The mere fact that a transparent electrode is employed as the top and bottom surfaces is not in itself a teaching that light exits through both surfaces. A good reason to place ITO on the bottom surface, even though no light exits there, in a research context would be to investigate the electrical properties of ITO when used as a contact in a VCSEL.

The invention as now defined in claim 18 is specifically directed to a bottom-emitting VCSEL. It appears that Martin discloses a top-emitting VCSEL because as described under *Fabrication*, the top mirror has only 15 layers, whereas the bottom mirror has 23 layers. The bottom layer thus is the more highly reflective layer. Light is clearly collected from the low reflectivity layer. Martin states that the structure is grown by vapor-phase epitaxy, so there must be a substrate under the bottom layer on which the epitaxial growth can occur, and the ITO contact must be deposited on the substrate. VCSELs are traditionally described in terms of the order in which they are made. The bottom layer is the one closest to the substrate. In this configuration, in the absence of the teaching of a light port, which is not taught in Martin, there

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would be no light exiting through the bottom surface through the substrate despite the fact that ITO is used as the electrode. The mere fact that he uses an ohmic contact that is transparent does per se not teach that light is emitted through this contact in the presence of an overlying substrate, which in the absence of a light output port, is not transparent.

Applicants contend that Martin does not show a low reflectivity mirror adjacent the substrate. The low reflectivity mirror in Martin is the top one, and therefore not adjacent the substrate. Moreover, since Martin clearly discloses a top-emitting VCSEL for the reasons stated, there is no teaching in Martin of a light output port located in the substrate, contrary to what is stated by the Examiner. The Examiner has attributed far more to the teachings of Martin than are actually present.

In order to allege *prima facie* obviousness, the Examiner combines Martin with Imai or Yanagawa, neither of which relates to a VCSEL. Both relate to edge-emitting lasers. Since the electric field is not applied in the same direction as the light emission, there would be no motivation to employ a conductive material on the emitting surfaces.

There appears to be a significant disagreement with the Examiner over what Imai and Yanagawa actually show. The Examiner states that "it is not clear from the description and drawings that both Imai and Yanagawa relate to edge-emitting lasers and not surface-emitting lasers". This statement is respectfully traversed.

Taking Imai first, he shows in Figure 9 a laser diode for use in his invention. The electrodes are shown as 80, 84, and 92, and the light output is shown by the arrow 94. See the passage commencing at line 14, col. 6. Clearly, this is an edge-emitting laser, not a surface emitting laser. The Examiner is therefore respectfully requested to reconsider his position.

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There would clearly be no motivation to use ITO on the top and bottom surfaces of an edge-emitting laser because light does not exit these surfaces.

The Examiner's primary reference is Martin. A combination of Martin and Imai does not result in the invention because Martin only teaches generally collecting light from either the top or bottom surface (see quotation noted above), and in particular in the structure described by Martin, light can only exit from the top surface. Imai teaches a monitor in connection with an edge-emitting laser, where the light exits in a direction orthogonal to the applied electric field from both sides of the laser, and where there would be no purpose in applying an ohmic contact.

With regard to Yanagawa, the Examiner admits that from the drawings the "semiconductor laser may appear to be an edge-emitting laser". The fact that Yanagawa's system can be used in CD players does not overcome this "apparent" disclosure. On the contrary, if the Examiner refers to the article "Building a Better Laser" from the May 29, 2000 Edition of Computerworld, (<http://www.computerworld.com/news/2000/story/0,11280,45186,00.html>) the following is stated:

"On the other hand, semiconductor lasers, which are much more common, are very small and use very little power. There are two kinds: edge-emitting and vertical-cavity. In edge-emitting lasers, which are less expensive than vertical-cavity lasers, the sides of the semiconductor are cleaved to make a mirror, and the beam shoots out of the edge. While more than 50 million are manufactured every year and used in devices such as CD players, the mirrors and thus the beam are imprecise and aren't suited to high-speed networking."

In 1992 when Yanagawa was filed, it is more likely that the laser was a less-expensive edge-emitting laser, consistent with the drawings, and consistent with the fact that precision is not required. It is respectfully submitted that there is no basis for suggesting that the laser

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employed in either Yanagawa or Imai is anything other than an edge-emitting laser as "apparently" shown in the drawings.

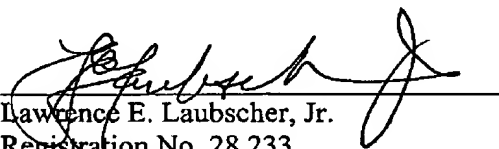
In summary, it appears as though the Examiner is reading into the cited documents more than is actually disclosed. In particular, nowhere in the prior art is there disclosed the fact that useful light for monitoring purposes can be extracted from both surfaces of a VCSEL. When properly interpreted, the prior art does not, either alone or in combination, disclose the invention as claimed. Accordingly, reconsideration and withdrawal of the rejection of claims 18-25 under §103(a) is requested.

It is believed that this application is in condition for allowance. If the Examiner has any objections that could be dealt with on the telephone, he is respectfully requested to telephone the undersigned.

Allowance of claims 18-25 is courteously solicited.

Respectfully submitted,

March 17, 2004

  
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